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ASSIGNMENT 7.

A. Find the tangent and normal

1. $y = 2x^2$ at point $(1, 2)$

SOLUTION

$\frac{dy}{dx} = 4x$

$m = \left.\frac{dy}{dx}\right|_{x = x_1}$

$m = 4(1)$

$m = 4$

Tangent : $y - y_1 = m(x - x_1)$

$y - 2 = 4(x - 1)$

$y - 2 = 4x - 4$

$y - 4x + 2 = 0$: which gives the equation of the tangent

Normal : $m_2 = \frac{-1}{m_1} = \frac{-1}{4}$

$y - y_1 = m(x - x_1)$

$4(y - 2) = -\frac{1}{\cancel{4}}(x - 1) \quad \times 4$

$4y - 8 = -x + 1$

$4y + x - 9 = 0$: which gives the equation of the normal

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2. $y = 3x^2 - 2x \qquad (2, 8)$

$\frac{dy}{dx} = 6x - 2$

$m = \left.\frac{dy}{dx}\right|_{x = x_1}$

$m = 6(2) - 2 = 12 - 2 = 10$

Tangent $y - y_1 = m(x - x_1)$

$y - 8 = 10(x - 2)$

$y - 8 = 10x - 20$

$y - 10x + 12 = 0$

Normal : $m_2 = \frac{-1}{m_1} = \frac{-1}{10}$

$(y - y_1) = m_2(x - x_1)$

$10(y - 8) = \frac{-1}{\cancel{10}}(x - 2) \times \cancel{10}$

$10y - 80 = -x + 2$

$10y + x - 82 = 0$

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3. $y = \frac{x^3}{2}$ $\quad (-1, -\frac{1}{2})$

$\frac{dy}{dx} = 3x^2 \times \frac{1}{2} = \frac{3x^2}{2}$

$m = \frac{dy}{dx}\Big|_{x=-1} = \frac{3(-1)^2}{2} = \frac{3}{2}$

Tangent: $(y - y_1) = m(x - x_1)$

$(y - (-\frac{1}{2})) = \frac{3}{2}(x - (-1))$

$2 \times (y + \frac{1}{2}) = \frac{3}{\cancel{2}}(x + 1) \times \cancel{2}$

$2y + 1 = 3x + 3$

$2y - 3x - 2 = 0$ which gives the equation of the tangent

Normal $m_2 = \frac{-1}{m_1}$

$m_2 = -1 \div \frac{3}{2} = -1 \times \frac{2}{3}$

$m_2 = -\frac{2}{3}$

$(y - y_1) = m_2(x - x_1)$

$(y - (-\frac{1}{2})) = \frac{-2}{3}(x - (-1))$

$3 \times (y + \frac{1}{2}) = \frac{-2}{\cancel{3}}(x + 1) \times \cancel{3}$

$3y + \frac{3}{2} = -2x - 2$

$3y + 2x + \frac{7}{2} = 0$

Or $6y + 4x + 7 = 0$: which gives the equation of the normal

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4 $y = 1 + x - x^2 \qquad (-2, -5)$

$\frac{dy}{dx} = 1 - 2x$

$m = \frac{dy}{dx}\Big|_{x=x_1}$

$m = 1 - 2(-2) = 1 + 4 = 5$

Tangent : $(y - y_1) = m(x - x_1)$

$(y - (-5)) = 5(x - (-2))$

$y + 5 = 5x + 10$

$y - 5x - 5 = 0$: which gives the equation of the tangent

Normal : $m_2 = -\frac{1}{m_1}$

$m_2 = -\frac{1}{5}$

$(y - y_1) = m_2(x - x_1)$

$5 \times (y - (-5)) = -\frac{1}{\cancel{5}}(x - (-2)) \times \cancel{5}$

$5y + 25 = -x - 2$

$5y + x + 27 = 0$: which gives the equation of the normal

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5. $y = \frac{1}{x}$ $\quad (3, \frac{1}{3})$

$y = x^{-1}$

$\frac{dy}{dx} = -1x^{-2} = \frac{1}{x^2}$

$m = \frac{dy}{dx}\Big|_{x=x_1} = \frac{-1}{(3)^2} = \frac{-1}{9}$

Tangent: $(y_2 - y_1) = m(x - x_1)$

$9 \times (y - \frac{1}{3}) = \frac{-1}{\cancel{9}}(x-3) \times \cancel{9}$

$9y - 3 = -x + 3$

$9y + x - 6 = 0$: which gives the equation of the tangent

Normal $m_2 = \frac{-1}{m_1} = -1 \div \frac{-1}{9} = \cancel{-1} \times \frac{9}{\cancel{1}}$

$m_2 = 9$

$y - y_1 = m_2(x - x_1)$

$\left(y - \frac{1}{3}\right) = 9(x-3)$

$y - \frac{1}{3} = 9x - 27$

$y - 9x + \frac{80}{3} = 0$

$3y - 27x + 80 = 0$: which gives the equation of the normal